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RESEARCH PAPER

Perceptions, Preferences, and Attitude of Bangladesh Farmers Towards Homegarden Farming Systems

Mahbubul Alam · Yasushi Furukawa · Matsumoto Mika

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Abstract An empirical study was conducted of the attitudes, perceptions and preferences of owners of homegardens in Bangladesh. A wide spectrum of opinions regarding various agroforestry issues was observed. Landholders were found to maintain their homegardens mainly for subsistence, although some additional family income was derived from selling surplus products. Due to lack of scientific knowledge the growing stock of homegardens was not of high quality. Seedlings were mostly preferred to other planting materials. Mango was accorded the highest 'preference ranking' among the available species. The farmers expected a number of external support measures, including high quality planting materials, assured credit facilities, and access to state-of-the-art management knowledge. It was concluded that various perceptions, preferences and attitude of the farmers would provide a framework for future policy formulation, preparation of homegarden management plans and development of homegardens in the study area and more generally in Bangladesh.

Keywords Species preference · Environmental awareness · Planting materials · Motivation

M. Alam
The United Graduate School of Agricultural Sciences, Ehime University, Matsuyama, Japan

Y. Furukawa · M. Mika
Forest Management Laboratory, Faculty of Agriculture, Kochi University, Kochi, Japan

M. Alam (✉)
Faculty of Agriculture, Monobe Otsu 200, Kochi 7838502, Japan
e-mail: malam.ku@gmail.com

Introduction

As in many other tropical countries, homegardens are well-established and vitally important traditional farming systems of Bangladesh (Millat-e-Mustafa et al. 1996). The homegardens represent intimate combinations of trees and crops of various species, sometimes in association with domestic animals, around the homestead (Nair and Kumar 2006). They are characterized by multistoried vegetation of shrubs, bamboos, palms and trees that produce building materials, fruit and other foods, fodder, resins and medicines (Dauglas 1981). The terms *homegarden*, *homestead forest* and *homestead agroforest* are treated as synonymous in literature and are used interchangeably (e.g. Leuschner and Khaleque 1987; Rahman et al. 2005). About 270,000 ha homegardens of Bangladesh are solely owned and managed by farmers, and management is traditional and sometimes indigenous in nature. Agroforestry products are grown for subsistence as well as cash needs. It is estimated that about 80–82% of forest products produced annually in the country come from this agroforestry farming system (GOB 1992). The national forest policy recognizes the importance of homestead forests and stresses the importance of scientific management interventions (GOB 2008). However, a national management plan for homegardens of Bangladesh is yet to be prepared.

Homegardens of Bangladesh have been investigated by various authors (e.g. Leuschner and Khaleque 1987; Abedin et al. 1988; Millat-e-Mustafa et al.1996; Salam et al. 2000; Rahman et al. 2005, 2006; Alam 2008). However, little in-depth information is available about the farmers' perceptions, preferences and attitudes (PPAs) towards their homegardens and the factors affecting these PPAs. Any scientific management effort in future improvement of this farming system will be fruitless unless the attitude of key stakeholders is well understood. The farmers are the owners, key stakeholder and decision-makers of the homegardens. The traditional 'top–down approach' of forest management is unlikely to be effective, because farmers will firmly oppose any strategy imposed upon them from external sources.

According to social exchange theory (e.g. Ekeh 1974), people develop attitudes toward other people and things in the context of anticipated personal beliefs and costs to be derived from dealing with them. Things that generate net benefits will tend to be perceived positively, while those that generate net losses will tend to be perceived negatively. It is also argued that farmers tend to contribute to an activity program that has a positive net benefit. As each farmer seeks the highest value in an activity, they will tend to choose activities that offer at least as much, in terms of socioeconomic and environmental benefits, as they would derive from alternate activities (Napier and Napier 1991).

The success of natural resource management projects depends on the biophysical as well as the socio-economic and cultural contexts within which they operate (Urgessa 2003). Perceptions are an important component of environmental education, and understanding farmers' perceptions about the environment provides a framework for forest conservation and management (Dolisca et al. 2007). This is why, to ensure socially, ecologically and economically sustainable homegarden agroforestry it is important to understand the owners' PPAs. Analysis of farm holders' attitudes also helps policy-makers and foresters to develop policy

instruments and management plans taking into consideration the views of key stakeholders.

Farmers' PPAs determine key management decisions for their homegardens; any specific PPA of farmers is determined by their socio-economic background, and level of understanding of management issues. The farmers' PPAs may also differ according to local cultural, economic and environmental contexts. For instance, one farmer may choose to plant fruit trees considering the number of children in his family, while another may decide to grow timber trees that can perform 'insurance' and 'safety net' roles. Dolisca et al. (2007) in Haiti found that the gender, age, education level, place of birth, group membership, land tenure and income level in the community influence farmers' perceptions. Additionally, the PPAs of the farmers are the result of their traditional knowledge of the environment; such traditional knowledge is further differentiated by ethnicity, as well as socioeconomic and demographic characteristics (Ayantunde et al. 2008). Hence an understanding of this complex correlation is important to reinforce the efforts of management interventions of any kind. A number of studies on people's perceptions and attitudes are available in literature—e.g. Napier and Napier 1991; Hartup 1994; Jacobson and Marynowski 1997; Hill 1999; Stein et al. 1999; Karppinen and Hanninen 2000; Urgessa 2003; Dolisca et al. 2007—but no study has been set solely in the context of homestead forests or homegarden management.

This study has attempted to explore the homegarden farmers' attitudes, preferences and perceptions as well as their environmental awareness. The specific objectives were to explore the purpose and motivation of tree growing on their farms, to investigate tree species choice and ranking, and to generate recommendations for improving traditional management practices.

The Study Area

The study was conducted in the villages of Porsha *thana* (sub-district) in Naogaon district of Bangladesh (Fig. 1), as part of a larger ethnobotanical research project conducted in the homegardens of the north and north-western region of Bangladesh. Porsha *thana* has an area of 252.8 km^2 and a population of 7,743 (male 51.7%, female 48.3%). Employment groups include agriculture 48.3%, agricultural labourer 29.0%, wage labourer 3.3%, commerce 5.2%, services 3.6% and others 10.6% (Banglapedia 2009). Among peasants, 20% are landless, 14% have small and marginal landholdings and 30% medium sized landholdings, and 36% are well off (Banglapedia 2009). A number of ethnic nationals, including Kurmi, Munda, Pahan Mura and Mal, are also resident of the study area. The main agricultural crops grown are rice, wheat and mustard seed, and the main fruits are mango, jackfruit, litchi and jujube.

Research Method

Two-stage sampling was employed for data collection. In three randomly selected villages (Mahadanga, Mulukdanga and Chaor) of Porsha *thana* altogether 96

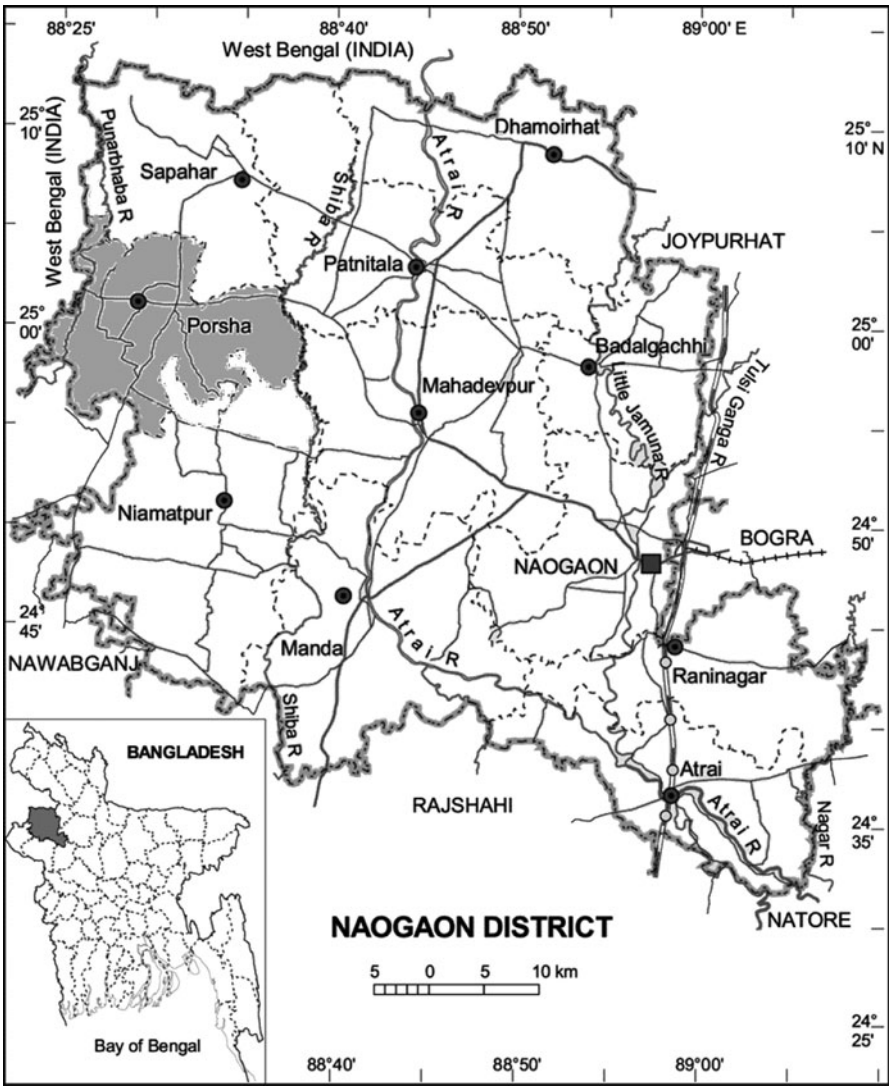

Fig. 1 Location of the study area (*Source*: Banglapedia)

smallholder farmers were randomly selected following the landholding classification criteria of BBS (2001).[1] A questionnaire was developed to identify change of species composition over time, motivation of growing a particular species and environmental awareness. Before finalizing, the questionnaire was trialed informally on a number of farmers. Landholders (usually heads of households) were personally interviewed during October 2007 to May 2008. In addition to structured questions, informal discussions were provoked through open-ended questions with

[1] Farmers were classified into four landholding categories: marginal (<0.4 ha), small (0.41–1.01 ha), medium (1.02–3.03 ha) and large (>3.03 ha).

Table 1 Allocating rank points to a hypothetical set of farmers' species preferences

Farmer's identification	Rank/rank point	Species				
		Species A	Species B	Species C	Species D	Species E
Farmer X	Rank	1	3	5	4	2
	Rank point	1.0	0.6	0.2	0.4	0.8
Farmer Y	Rank	1	3	4	5	2
	Rank point	1.0	0.6	0.4	0.2	0.8
Total rank point		2.0	1.2	0.6	0.6	1.6
Order of overall species preference (from higher to lower): A, E, B, (C, D)[a]						

[a] Species within the parenthesis bear the same rank point; 0.6 for both C and D species in this case

the farmers and other family members about common forestry and environmental issues during interviews. This allowed crosschecking of the validity of the survey responses. There were five statements to which respondents were asked to indicate their level of agreement, on a 5-point Likert scale.

The survey data were analyzed using SPSS and presented in cross-tab format using descriptive statistics according to landholding size classes. Chi-squared tests with a 5% level of significance were used to examine whether farmers' PPAs were uniformly distributed or more oriented towards particular categories of answers. The null hypothesis was that there is no disagreement between the observed and theoretical distributions. Cramer's phi (φ) statistic (as described by Zar 1999) was used as a measure of strength of association between rows and columns in contingency tables. The φ statistic is defined as:

$$\varphi = \sqrt{\frac{\chi^2}{n(k-1)}}$$

where n is the number of observations and k is the number of rows or columns, whichever is the smaller.

The field survey investigated a preference ranking among respondent farmers for tree species. Farmers were asked to list their five most preferred species. Each species was assigned a rank and a corresponding rank point. The rank points for 1st, 2nd, 3rd, 4th, and 5th ranked species were 1.0, 0.8, 0.6, 0.4, and 0.2, respectively. Finally, total rank point of a particular species was calculated by adding rank points generated from each farmer's preference of that species. Table 1 demonstrates details of species preference ranking method for a hypothetical scenario, in which five species are allocated ranks by two farmers.

Results and Discussion

Table 2 presents the findings of the PPA survey, along with Chi-square and Cramer's statistics, of the homegarden farmers in the study area, and the following sections discuss in detail the findings presented in the table.

Table 2 PPAs of farm holders towards key forestry issues in northwestern Bangladesh

Question	Alternative answers	Response frequency and relative frequency	Marginal	Small	Medium	Large	Total	χ^2	*P* value	Degrees of freedom	Cramer's φ
How has the homegarden changed over the last 10 years?	Increased	*N*	6	9	14	18	47	18.57	0.005	6	0.311
		%	33	54	46	42	44				
	Decreased	*N*	6	6	6	5	23				
		%	29	25	25	21	25				
	Unchanged	*N*	12	9	4	1	26				
		%	38	21	29	37	31				
Do you have enough land for homegarden?	Enough	*N*	6	6	14	15	41	12.7	0.0481	6	0.2572
		%	25	25	58	63	43				
	Medium	*N*	7	8	4	3	22				
		%	29	33	16	13	23				
	Not enough	*N*	11	10	6	6	33				
		%	46	42	25	24	34				
Why do you grow trees?	Own use	*N*	6	4	7	6	23	1.38	0.9671	6	0.0848
		%	25	17	29	25	24				
	Own use and cash	*N*	13	13	12	12	50				
		%	54	54	50	50	52				
	Environmental	*N*	5	7	5	6	23				
		%	21	29	21	25	24				
Fruit or timber species-which do you like best?	Fruit	*N*	6	6	15	14	41	12.68	0.0481	6	0.26172
		%	25	25	63	58	43				
	Timber	*N*	7	3	4	8	22				
		%	29	13	16	33	23				
	Both	*N*	6	10	6	11	33				
		%	24	42	25	46	34				

Table 2 continued

Question	Alternative answers	Response frequency and relative frequency	Marginal	Small	Medium	Large	Total	χ^2	*P* value	Degrees of freedom	Cramer's φ
How do you rank quality of fruit bearing trees?	Good	*N*	11	10	12	15	48	5.19	0.5197	6	0.1644
		%	46	42	50	63	50				
	Moderate	*N*	5	9	6	3	23				
		%	21	38	25	13	24				
	Poor	*N*	8	5	6	6	25				
		%	33	21	25	25	26				
How do you rank quality of timber producing species?	Good	*N*	4	6	6	5	21	9.72	0.1369	6	0.2227
		%	17	25	25	20	22				
	Moderate	*N*	14	5	11	9	39				
		%	58	20	46	38	41				
	Poor	*N*	6	13	7	10	36				
		%	25	55	29	42	38				
How do you regard the selling price of seedlings?	High	*N*	11	8	7	2	28	13.62	0.0342	6	0.2663
		%	46	33	29	8	29				
	Fair	*N*	9	10	10	8	37				
		%	38	42	42	33	39				
	Cheap	*N*	4	6	7	14	31				
		%	17	25	29	58	32				
Which type of species does you like most?	Exotic	*N*	5	7	6	9	27	6.05	0.4176	6	0.1784
		%	20	29	25	38	28				
	Local	*N*	14	9	8	7	38				
		%	58	38	33	29	40				
	Both	*N*	5	8	10	7	30				
		%	20	33	42	29	32				

Table 2 continued

Question	Alternative answers	Response frequency and relative frequency	Marginal	Small	Medium	Large	Total	χ^2	*P* value	Degrees of freedom	Cramer's φ
Which type of species grows better?	Exotic	*N*	5	6	5	8	24	4.85	0.5632	6	0.1589
		%	21	25	21	33	25				
	Local	*N*	13	8	12	7	40				
		%	54	33	50	29	42				
	Both	*N*	6	10	7	9	32				
		%	25	42	29	38	34				
What is the most serious constraint in homegarden development?	Financial	*N*	10	14	8	3	35	13.37	0.0375	6	0.2639
		%	42	58	33	13	37				
	Technical	*N*	8	5	9	8	30				
		%	33	21	38	33	31				
	Others	*N*	6	5	7	13	31				
		%	25	21	29	54	32				
What is your recommendation for homegarden development?	Awareness	*N*	8	6	7	8	29	1.49	0.9602	6	0.0881
		%	33	25	29	33	30				
	Cottage industry	*N*	5	7	5	7	24				
		%	21	29	21	29	25				
	Marketing facility	*N*	11	11	12	9	43				
		%	46	46	50	38	45				
Are you aware of the environmental change taking place in this region?	Yes	*N*	15	20	19	23	77	7.98	0.0464	3	0.2854
		%	62	83	79	96	78				
	No	*N*	9	4	5	1	19				
		%	38	17	21	4	22				

Availability of Forestland and its Change over Time

Land availability is a severely limiting factor for expansion of vegetation in the heavily populated country of Bangladesh. Nevertheless, 44% of respondents deemed the extent of homegardens had increased during the last decade (Table 2). Respondents with larger landholdings were more inclined to report that homegarden size had increased, the Chi-squared statistic being significant ($\chi^2 = 18.57$, *df* 6, $P < 0.005$), associated with a high Cramer's phi statistic ($\varphi = 0.31$) indicating a strong relationship between rows and columns. About 43% of the respondents considered that they had enough land for homegardening. Such opinion is significant as well in Chi-square test ($\chi^2 = 12.7$, *df* 6, $P < 0.005$, $\varphi = 0.26$).

Motivation of Tree Growing

The farmers tend to maintain homegardens for multifunctional roles, including provisioning (e.g. food, timber), regulating (e.g. microclimate amelioration), cultural and supporting services. The majority (52%) reported that they used forest products for both own use and sale to earn cash income, while 24% replied that they intended household use only, and the same percentage replied that their main purpose for growing trees was providing protection for household infrastructure against windstorm as well as for other environmental benefits.

Choice and Quality of Species Grown

A number of factors determine the farmers' decisions for growing particular species or groups of species. The farmers are keen to grow timber trees for cash income if they already have a successful strategy for deriving income from off-farm labour (e.g. rickshaw pulling) or from crops. Farmers with large families tend to grow fruit trees. About 43% of the respondents reported a preference for fruit trees and 23% had a preference for timber trees.

About half the respondents answered that the fruit trees they grew were of high quality, while in answer to another question—'How do you regard the quality of timber species?'—the largest subset (41%) answered that the timber trees were not of expected quality in terms of diameter size and growth rate. More than one-third farmers (38%) believed their timber producing trees to be of poor quality. Both these results are not statistically significant according to Chi-square tests across the landholding size classes. About 40% reported that they preferred native species over exotics. As revealed in the next question, 42% considered that native species grow better in the homesteads, while only 25% said that exotics perform better than natives. No statistically significant difference could be identified in the answers across farm size classes ($\chi^2 = 4.85$, *df* 6, $P > 0.005$, $\varphi = 0.15$).

Selection of Planting Materials

Seedlings, seeds, cuttings and clonally propagated materials were used as planting materials, the choice depending on price, ready availability, ease of maintenance

and growth rate. Farmers were found to purchase seedlings in most cases although there were instances of using self-saved reproductive materials. No wildings were reported to be used as planting materials. Regarding prices of planting materials, 39% of forest owners replied that the prices were fair and the rest were divided in opinion in similar percentages (high, 29%; low, 32%). The analysis revealed significant differences of opinions across farm size classes ($\chi^2 = 13.62$, *df* 6, $P < 0.005$, $\varphi = 0.27$).

Species Preference Ranking

As indicated in Table 3, *Mangifera indica* ranked top of the list of preference ranking with a rank point of 89.25, out of a possible 96, followed by *Artocarpus*

Table 3 Ranking of most preferred species among the respondent farmers

Scientific name	Local/English name	Principal use[a]	Rank point
Mangifera indica	Mango	Fr, T	89.25
Artocarpus heterophyllus	Jackfruit	T, Fr, Fu	33.75
Lychi chinensis	Litchi	Fr	12.75
Azadirachta indica	Neem	M, T	12.50
Cocos nucifera	Coconut	T, Fr, Fu	12.50
Syzygium cumini	Jam	Fr, T	10.75
Ziziphus mauritiana	Jujube	Fr	8.25
Averrhoa carambola	Kamranga	Fr	7.25
Switenia macrophylla	Mahogany	T	6.50
Bambosa spp.	Bamboo	Rural construction	5.25
Spondias dulce	Amra	Fr	5.00
Phoenix sylvestris	Date palm	Fr	4.50
Eucalyptus camaldulensis	Eucalyptus	T, Fu	4.25
Areca catechu	Betelnut	T, Fu	4.00
Emblica officinalis	Amloki	Fr, M	3.25
Albizia saman	Raintree	T, Fu	3.25
Aegle marmelos	Bel	Fr, M	3.00
Albizia procera	Koroi	T, Fu	2.75
Citrus grandis	Jambura	Fr	2.50
Dalberzia sisoo	Sisoo	T, Fu	2.00
Anthocephalus chinensis	Kadam	T, Fu	1.75
Acacia auriculiformes	Acacia	T, Fu	1.50
Artocarpus chaplasha	Chapalish	T	0.75
Leucaena leucocephala	Ipil-Ipil	Fo, Fu	0.75
Michelia champaca	Champa	T	0.75
Tectona grandis	Teak	T	0.75
Dellenia indica	Chalta	Fr	0.25
Gmelina arborea	Gamar	T	0.25

[a] *Fr* fruit, *Fo* fodder, *M* medicinal, *T* timber

heterophyllus (33.75). In fact, these two species (mango and jackfruit) are most commonly preferred and grown by people across the country. This ranking is consistent with the findings of others studies (e.g. Rahman et al. 2005, 2006). Other species having comparatively higher rank points are *Lychi chinensis*, *Azadirachta indica*, *Cocos nucifera*, and *Ziziphus mauritiana*. The large gap between the rank points of mango and other species arises because mango growing in this region is famous across the country and is the principal cash earning fruit species in many homegardens (Abedin et al. 1988). Among the timber species (including exotics), mahogany ranked first with a rank point of 6.50, followed by *Albizia saman* (6.25) and *Eucalyptus camaldulensis* (4.25). Those low rank points are consistent with the findings reported in Table 2, that only 23% respondents preferred timber species and only 28% reported a preference for exotics. *Azadirachta indica* is the only species in the preference list valued for both medicinal and timber use, and is among the most preferred five species with a rank point of 12.50. Two other medicinal plants, producing edible fruits as well (*Emblica officinalis* and *Aegle marmelos*) were found to have relatively low rank points of 3.25 and 3.00, respectively. The total number of species available in the study area is more than the number of species mentioned in preference ranking, because some species were not listed in the short list of five preferred species by any respondent.

Environmental Concerns Among the Farmers

The overall environmental condition of the study area is harsh, with high variability of temperature and precipitation. A number of climatic and environmental hazards are threatening rural livelihoods. Frequent incidence of drought spells with the visually identifiable trend of desertification is a major environmental threat of this region (FAO 2006; Alam 2008). In such a background the farmers were asked a technical question: 'Are you concerned about the environmental degradation of this region and do you understand the role of homegardens in such circumstances?' In answer, 78% of respondents informed that they were aware of the prevailing trend of desertification as a consequence of long-term climate variability. They also believed that homegardens could play a crucial role by increasing the land cover with trees. The environmental awareness among farmers of various landholding categories is statistically significant ($\chi^2 = 7.98$, *df* 6, $P < 0.005$, $\varphi = 0.28$).

Perceived Constraints and Farmers' Recommendations for Homegarden Development

Regarding the most serious constraints in homegarden development, 37% identified 'financial constraint', while about 31% identified 'lack of technical knowledge' in developing homegardens. Other constraints include lack of adequate land area, lack of awareness of the socioeconomic and environmental importance of homegardening, and lack of external support. The difference in perceptions of constraints is statistically significant ($\chi^2 = 13.37$, *df* 6, $P < 0.005$, $\varphi = 0.26$).

The respondents were asked to provide recommendations for homegardens development. Among a wide range of recommendations were supplying them with

Table 4 Summary of the farmers' perceptions towards five statements

Statement	Average rating[a]
a. Homegarden is important for my livelihood	4.12
b. I am aware of the environmental change of this region	4.08
c. Homegardens can play adaptation and mitigation role in the prevailing environmental context	3.90
d. Government and non-government extension agencies have sufficient initiatives for homegardens development	0.78
e. I need management support from extension agencies	2.35

[a] 0, 'I do not know'/'I do not agree', through to 5, 'I strongly agree'

high quality planting materials from government sources, supporting them with credit facilities, and adequately equipping them with scientific know-how for better management of their homegarden resources.

Response to the Perception Statements

Strength of agreement of respondents regarding the homegardens was sought with respect to five perception statements, on a 5-point Likert scale. Average ratings ranged from 0.78 to 4.12 (Table 4). The farmers strongly believed that homegardens were highly important for their livelihood (rating 4.12). The overall perception that a gradual environmental change is taking place in the region was also widely agreed with (rating 4.08). They also agreed relatively strongly that homegardens could potentially play an adaptation and mitigation role with respect to climate change. The respondents also perceived poor extension performance of government and non-government agencies (NGOs) regarding promotion and development of homegardens, and this is revealed in the 4th statement with a corresponding rating of only 0.78. This could be the reason why the farmers expressed the necessity of extension support from respective government and non-government agencies, which is revealed in the 5th statement with relatively higher average rating (2.35).

Conclusion

The area under homegardens in the country is increasing because of the intensive utilization of vacant spaces around the living quarters. The motivations for growing vegetation include household-consumption and generation of cash income. A wide range of species, although dominated by few, is preferred for incorporation in the homegardens and such preference is the result of intended end-use of those species. Dependency on homegardens is increasing to secure household livelihoods because the agricultural sector is particularly sensitive to prevailing climate variability of the region. The variations of farmers PPAs observed in this study on motivations of tree farming, choice and quality of species grown, farmers' species preference, environmental concern, perceived constraints and recommendations will provide

a framework for future policy formulation and preparation of homegarden management plans at national and regional level.

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